The Standard Model (SM) of particle physics has been remarkably successful in describing fundamental particles and their interactions through the electromagnetic, weak, and strong forces.We analyze the BLSSM's extended Higgs sector, which features additional CP-even, CP-odd, and charged Higgs states, and discuss their distinctive collider signatures compared to the SM and MSSM in addition we summeriez The Large Hadron Collider (LHC) and Detector Systems then , A detailed overview of the LHC, the world's most powerful particle accelerator, is provided, covering its design, proton-proton collision mechanics, and operational energies (e.g.,s=13-14 TeV).These gaps motivate the study of BSM theories, particularly SUSY and its extensions, which offer solutions to these problems while preserving the SM's predictive power, then we introduce supersymmetry, a spacetime symmetry that pairs fermions with bosons, and its minimal realization, the Minimal Supersymmetric Standard Model (MSSM).Finally , we display The results and the analysis of the pp->H->bb signal, comparing its luminosity-normalized yield against dominant backgrounds (QCD multijets, tt, Z+jets) to establish significance.Kinematic distributions including the invariant mass (mbb) of b-jet pairs, transverse momentum (pT), and angular separation (?R) are shown for both sm (~125 GeV) and light (92 GeV) Higgs hypotheses, with figures highlighting the signal's mass peak and background .We investigate the phenomenological implications of the BLSSM, focusing on Higgs boson production and decay at the Large Hadron Collider (LHC), and assess its detectability through detailed event generation and analysis.Using Monte Carlo (MC) event generators (MadGraph, Pythia, Herwig), we model proton-proton collisions, incorporating higher-order QCD corrections and parton showering.The BLSSM naturally explains neutrino masses via a seesaw mechanism and predicts new particles, including a ?heavy Z